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# Sun Tracking Solar Panel: Dual Axis To Maximize Solar Energy

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ABSTRACT :

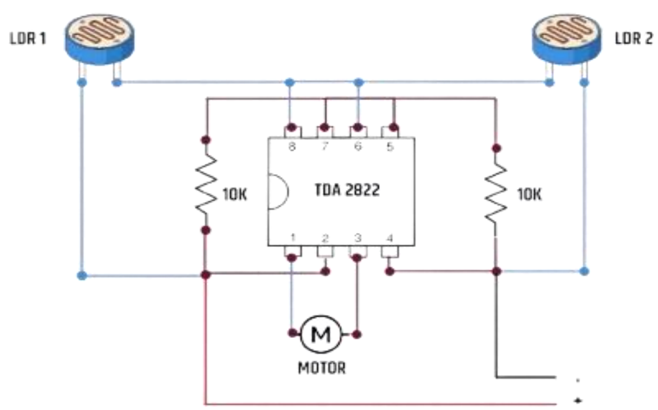
A sun taking after sun based board system is arranged to move forward the capability of sun arranged imperativeness time by normally changing The sun area arranged board as well take after a improvement of sun over the sky. Not at all like routine settled sheets, which remain in a settled position, sun taking after systems can move to capture the most extraordinary whole of sunshine all through the day. This is particularly basic since the point at which sunshine hits a sun fueled board impacts its capacity to make power. In this wander, A two-dimensional sun tracker is utilized, which licenses the sun situated board to move both equally and vertically to track the sun's point in the sky. This sort of tracker ensures that the board is ceaselessly standing up to the sun, maximizing the imperativeness it captures. The system businesses sensors to distinguish the concentrated of the sunshine from unmistakable headings and sends this information to motors that modify the panel's position accordingly.By utilizing a dual-axis sun tracker, the capability of the sun arranged board can be essentially extended, as it modifies to the sun's advancement both in the midst of the day and all through the seasons. This wander focuses to make a cost-effective and strong system that can be easily actualized to deliver more sun fueled control, contributing to the utilize.

**Keywords:** Two-dimensional sun tracker, Dual-axis sun tracker

## Introduction :

Sun fueled essentialness is one of the most guaranteed and clean References of Regenerative control. It is saddled utilizing sun based sheets that alter over sunshine into control. In any case, the whole of control a sun fueled board can create depends to a incredible degree on the point at which sunshine hits the board. If the board is not arranged at the right point, it won't capture as much sunshine, which diminishes its viability. This is especially veritable since the area of sun changes all through the day and as well shifts with the seasons.To address this challenge, sun taking after systems have been made. These systems are sketched out to move sun situated sheets to track the sun's advancement, ensuring that the board is ceaselessly standing up to the sun for most prominent essentialness absorption. "There are two primary sorts of sun trackers: single-axis trackers and dual-axis trackers. Single-axis trackers can..." as it were move in one course, as a run the show taking after the sun's way at the course of east to west. In separate, dual-axis trackers can move in both level and vertical headings, allowing the board to take after the sun more accurately all through the day and over the seasons.A dual-axis sun tracker has the potential to inside and out increase the adequacy of sun based sheets. By changing the presentation of the board both on a level plane side to side and vertically (up and down), it ensures the board is ceaselessly arranged at the perfect point to capture the most sunshine. This sort of tracker can increase the essentialness surrender of a sun based board by up to 40% compared to settled sheets, making it a beneficial instrument for maximizing sun fueled imperativeness generation. This expand centers on making a dual-axis sun taking after system that can thus change the area of the sun based board. The system will utilize light sensors to recognize the concentrated of sunshine from particular headings, and motors will change the panel's position based on the sensor input. The objective is to make a system that is direct, cost-effective, and strong, though besides maximizing the imperativeness surrender of sun situated sheets. By advancing the efficiency of sun based sheets, this amplify contributes to the broader objective of utilizing clean, renewable essentialness sources to meet around the world control needs.

**Fig1: "Circuit Diagram Of Sun Tracking Solar Panel"**



## Working:

A solar panel converts sunlight into electrical energy using photovoltaic cells, typically made of silicon. Four light-dependent resistors (LDRs) detect light intensity from the east, west, north, and south, producing varying voltage signals based on the light received. A comparator circuit analyzes these signals to generate logic outputs for east-west and north-south pairs. A motor driver IC, like the L293D, receives these outputs to control two DC motors that adjust the solar panel's orientation. A power supply ensures the circuit has the necessary voltage and current for operation.

**Component needed *:***

- ldr sensor
- gear motor
- TDA2822 IC
- resistor
- power supply (battery)
- solar panel

**Setup:**

- Position the LDRs to detect light from different angles.
- Connect the LDRs to a comparator circuit to generate control signals based on light intensity.

**Operation:**

- As light intensity changes, the system will move the solar panel for maintaining peak alignment with the sun, maximized the energy capture throughout the days **(1-5).**

## Literature Review :

A literature review on sun-tracking solar panel systems explores various advancements aimed at improving the efficiency of solar power collection. Traditional solar panels are typically fixed in place, which means they can only capture sunlight effectively at certain times of the day or seasons. To maximize energy production, sun- Tracking systems are created to monitor the path across the sky, ensuring that the panels are always positioned at the optimal angle. These system can be classify into two types: single-axis trackers, which rotate on one axis (usually east to west), and dual-axis trackers, which move on two axes (tracking both the sun's azimuth and altitude).Research has demonstrated that sun-tracking panels can increase energy output by 20-40% same on fixed panel. However, challenges such as higher installation costs, mechanical complexity, and maintenance requirements remain. Studies also discuss various materials and designs that aim to reduce the mechanical load and increase the reliability of tracking systems. Furthermore, advancements in control algorithms, sensors, and automation have made tracking systems more efficient, reliable, and cost-effective. In addition to technical improvements, some studies have highlighted the environmental benefits, as these systems can help reduce the overall land area required for solar energy production. However, while the promise of higher energy yields is clear, the economic viability of sun-tracking systems depends on local conditions such as sunlight availability, terrain, and the cost of installation.

## Problem Statement –

The problem with traditional solar panels is that they are fixed in one position and can only capture sunlight effectively at certain times of the day. the sun Shift across the sky, these panels may not always be angled correctly, which means they don't always generate the most energy possible. Sun-tracking solar panels, which follow the sun's movement, have the potential to increase energy production by Maintaining the panels at the best angle throughout the day. Still, these systems can be Complicated, expensive to install, and require more maintenance than fixed panels. The challenge is to design a sun-tracking system that is efficient, affordable, and reliable, so that it can make solar energy more accessiblity and effective for a wider range of users.

## Methodology –

The methodology for a "sun-tracking solar panel" project involves designing a system that can automatically Change the position of a solar panels to track the sun shifting during the day. First, sensors are used to detect the sun location in the sky, which helps the system know where the sun is at any given time. Based on this information, a control system moves the panels either along "single axis (east to west)" or "two axes ( track the sun position and its Peak)". The system is powered by a small motor that adjusts the panels accordingly, ensuring they are always at the optimal position for maximum power capture. To make the system more reliable and cost-effective, the design may include simple mechanical components or use smart algorithms to reduce the need for frequent maintenance. The Execution of the sun-tracking Network is then tested by comparing the energy output to that of traditional fixed panels, and adjustments are made to improve Capability and reduce Prices.

## Limitations –

One of the main limitations of sun-tracking solar panel systems is the higher initial cost. The technology required to make the panels move, "Particular as motors, sensors, and control method", adds to the overall expense Evaluated to traditional fixed panels. This can make sun-tracking systems less affordable for some people, especially in areas where solar energy is not heavily subsidized or where the installation costs are already high.

Another limitation is the increased complexity. The motors, sensors, and mechanical components need regular maintenance to keep them functioning properly. Additionally, the systems might not be suitable for all environments, such as in areas with extreme weather conditions or rough terrain, where the systems could be prone to damage. These factors make the technology less practical for some locations and can reduce its long-term reliability.

## Results –

The sun tracking solar panel project enhances energy efficiency by ensuring that the solar panel remains optimally aligned with the sun's path throughout the day. By employing components such as light-dependent resistors (LDRs), motor drivers such as the L293D, and simple electronic circuits, these systems can be developed without the requirement of an Arduino.

**Panel Efficiency and Performance Over Different Seasons**

| *Season* | *Output Watt (Fixed Panel)* | *Output watt (tracking Panel)* |
|---|---|---|
| **Winter (January)** | 110 W | 130 W |
| **Spring (April)** | 120 W | 160 W |
| **Summer (July)** | 125 W | 165 W |
| **Fall (October)** | 115 W | 150 W |

**Panel Rotation Efficiency**

| *Tracking* Performance *(%)* | *Tracking Panel Energy Output (W)* |
|---|---|
| **96%** | 150 W |
| **90%** | 140 W |

## Conclusion –

In conclusion, sun-tracking solar panels offer a promising way to increase the Performance of solar power systems by keeping the panels consistently positioned at the ideal angle to harness sunlight. This can result in greater energy generation compared to stationary panels. However, the technology comes with higher installation costs and more maintenance due to the moving parts involved. While these systems are not yet the best option for every situation, they can be a great choice in areas where maximizing energy production is crucial. With continued improvements in design and technology, sun-tracking systems could become more affordable and reliable, making them a more practical solution for widespread use in the future.

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